REMARKS/ARGUMENTS

Applicant thanks the Examiner for the very thorough consideration given the present application. Claims 9-34 are currently pending in this application.

In view of the brief discussion with the Examiner and the remarks herein, Applicant respectfully requests that the Examiner withdraw all outstanding rejections and allow the currently pending claims. Per the Examiner's instructions, Applicant's would like to point out that currently pending claim 21 is a method of making a composition that was allowed as claim 1 in U.S. Patent No. 7,425,367 (U.S. Serial No. 11/729,250), which this application is a divisional thereof. Currently pending claim 21 is provided with all of the limitations of the allowed claim 1 of U.S. Patent No. 7,425,367.

This is meant to be a complete response to the final office action mailed on December 11, 2008. The following is a disposition of the claims: Claims 1-8 have been previously canceled and claims 9-34 have been previously presented.

Claim Rejections - 35 USC § 102

In the Office Action dated December 11, 2008, the Examiner rejected claims 9-17, 19-28, and 31-33 under 35 U.S.C. 102(b) as being anticipated by Harwell et al. (U.S. Pat. No. 5,106,691).

Applicant respectfully submits that the above stated rejection of claims 9-17, 19-28, and 31-33 under 35 U.S.C. 102(b) is traversed. Applicant's claim 9, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers*** having at least one surface; and initiating an ***admicellar polymerization reaction*** on the at least one surface of the plurality of ***individual fibers*** to provide the at least one surface of the plurality of ***individual fibers*** with an admicellar hydrophobic polymer coating on at least one surface of the plurality of ***individual fibers***. (Emphasis added)

Additionally, Applicant's claim 21, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers*** having at least one surface; and applying an admicellar hydrophobic polymer coating on the at least one surface of the plurality of ***individual fibers*** wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating***. (Emphasis added)

The Harwell et al. reference (Harwell) discloses and claims a method for producing polymeric films in which a substrate surface is contacted with a surfactant solution to provide a surfactant template. Monomer molecules are provided and polymerized to produce the polymeric film. The substrate in Harwell includes objects which are porous, has non-planar surfaces, or particulate matter.

The Harwell reference does not teach, disclose, or even suggest a method for providing a substrate comprised of a plurality of ***individual fibers*** and initiating an ***admicellar polymerization reaction*** on the plurality of ***individual fibers***. Nor, does the Harwell reference teach a method including the step of applying an admicellar hydrophobic polymer coating on the at least one surface of the plurality of *individual fibers* wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating.*** Further, the substrates described in the Harwell reference do not include fibrous materials.

In view of the above, it is respectfully requested that the Examiner withdraw the rejection of independent claims 9 and 21, and thus claims 10-17, 19-28, and 31-33 for depending therefrom, under 35 U.S.C. 102(b), as applicable to claims now pending in the application.

Claim Rejections - 35 U.S.C. § 103

In the Office Action dated December 11, 2008, the Examiner rejected claims 18, 29 and 30 under 35 U.S.C. 103(a) as being unpatentable over Harwell et al. (U.S. Pat. No. 5,106,691)..

Applicant respectfully submits that the above stated rejection of claims 5-8 under 35 U.S.C. 103(a) is traversed. That is, it is respectfully submitted that that the prior art reference of Harwell does not disclose, teach, or even suggest the invention recited in claims 9 and 21, and thus claims 18, 29, and 30 for depending therefrom.

Applicant's claim 9, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers*** having at least one surface; and initiating an ***admicellar polymerization reaction*** on the at least one surface of the plurality of ***individual fibers*** to provide the at least one surface of the plurality of ***individual fibers*** with an admicellar hydrophobic polymer coating on at least one surface of the plurality of ***individual fibers***. (Emphasis added)

Additionally, Applicant's claim 21, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers***

having at least one surface; and applying an admicellar hydrophobic polymer coating on the at least one surface of the plurality of ***individual fibers*** wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating***. (Emphasis added)

The Harwell et al. reference (Harwell) discloses and claims a method for producing polymeric films in which a substrate surface is contacted with a surfactant solution to provide a surfactant template. Monomer molecules are provided and polymerized to produce the polymeric film. The substrate in Harwell includes objects which are porous, has non-planar surfaces, or particulate matter.

The Harwell reference does not teach, disclose, or even suggest a method for providing a substrate comprised of a plurality of ***individual fibers*** and initiating an ***admicellar polymerization reaction*** on the plurality of ***individual fibers***. Nor, does the Harwell reference teach a method including the step of applying an admicellar hydrophobic polymer coating on the at least one surface of the plurality of *individual fibers* wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating.***

Further, the substrates described in the Harwell reference do not include fibrous materials.

In view of the above, it is respectfully requested that the Examiner withdraw the rejection of dependent claims 18, 29, and 30 under 35 U.S.C. 103(a), as applicable to claims now pending in the application.

Claim Rejections - 35 U.S.C. § 103

In the Office Action dated December 11, 2008, the Examiner rejected claims 9-33 under 35 U.S.C. 103(a) as being unpatentable over Diehl et al. (U.S. Pat. No. 5,623,015) in view of Hartwell et al. (U.S. Pat. No. 5,106,691). The Examiner also rejected claims 9-33 under 35 U.S.C. 103(a) as being unpatentable over Raynolds et al. (U.S. Pat. No. 5,919,716) in view of Harwell et al. (U.S. Pat. No. 5,106,691).

Applicant respectfully submits that the above stated rejections of claims 9-33 under 35 U.S.C. 103(a) is traversed. That is, it is respectfully submitted that that the prior art references of Diehl and Harwell and the prior art references of Raynolds and Harwell, whether viewed singularly or in combination, do not disclose, teach, or even suggest the invention recited in independent claims 9 and 21, and thus claims 10-20 and 22-33 for depending therefrom.

Applicant's claim 9, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating

thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers*** having at least one surface; and initiating an ***admicellar polymerization reaction*** on the at least one surface of the plurality of ***individual fibers*** to provide the at least one surface of the plurality of ***individual fibers*** with an admicellar hydrophobic polymer coating on at least one surface of the plurality of ***individual fibers***. (Emphasis added)

Additionally, Applicant's claim 21, as presently presented, is directed to a method of making a substrate having an admicellar hydrophobic polymer coating thereon, comprising the steps of: providing a substrate comprised of a plurality of ***individual fibers***, each of the ***individual fibers*** having at least one surface; and applying an admicellar hydrophobic polymer coating on the at least one surface of the plurality of ***individual fibers*** wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating***. (Emphasis added)

"Admicellar polymerization" is defined in detail in paragraphs [0039]-[0041] of the instant specification, and shown schematically in Fig. 4. The three main steps, as defined, are (1) admicelle formation, (2) adsolubilization, and (3) polymerization. Admicelle formation is the absorption of two layers, i.e., a bilayer of surfactant onto a surface (see

paragraph [0037] and Fig. 4A). The presence of a bilayer can be confirmed by adsorption isotherms and the resulting polymer film by SEM. The polymer film thickness is thus caused to be roughly the same order of magnitude as the surfactant chain length.

Diehl et al. and *Raynolds et al.* teach specific compositions and methods for <u>emulsion polymerization.</u> See, for example, col. 2, lines 26-28 of *Diehl et al.*, and col. 5, lines 48-50 of *Raynolds et al.* Emulsion polymerization is a technique well known to those skilled in the art and quite distinct from admicellar polymerization. The attached article on Emulsion Polymerization defines "emulsion" as "[a] stable colloidal suspension as milk, consisting of an immiscible liquid dispersed and held in another liquid by a substance called an emulsifier." Emulsion polymerization is then described and depicted on pp. 2-3 of the attached article. In emulsion polymerization, the monomer is present as droplets in the water and also within the micelles. The micelles involved in the emulsion polymerization taught in *Diehl et al.* and *Raynolds et al.* are basically globular solubilizing entities in solution, rather than bilayers on the target surface as with admicelles. (See paragraph [0039] of Applicants' specification stating, "The initial feed concentration of surfactant is generally chosen close to but below the critical micelle concentration (CMC) 155 to avoid emulsion polymerization in micelles 70 and to maximize admicelle 120 formation.) "Formally, adsolubilization is

defined as the excess concentration of a species at an interface in the presence of the admicelle 120 that would not exist in the absence of the admicelle." (Paragraph [0040] of Applicant's specification.) The characteristics of polymer in a micelle are significantly different from polymer in an admicelle, and the resulting product properties reflect these basic chemical, sizes, and shape differences.

As stated above, the Harwell et al. reference (Harwell) discloses and claims a method for producing polymeric films in which a substrate surface is contacted with a surfactant solution to provide a surfactant template. Monomer molecules are provided and polymerized to produce the polymeric film. The substrate in Harwell includes objects which are porous, has non-planar surfaces, or particulate matter.

Additionally, the *Diehl et al.* and *Raynolds et al.* references, nor the combination of these references with the Harwell reference, do not teach, disclose, or even suggest a method including the step of applying an **admicellar hydrophobic polymer** coating on the at least one surface of the plurality of ***individual fibers*** wherein ***voids disposed between the plurality of individual fibers having the admicellar hydrophobic polymer coating on the at least one surface are free of the admicellar hydrophobic polymer coating***.

For the reasons set forth above, it is respectfully submitted that the *Diehl et al.* and *Raynolds et al.* references, nor the combination of these

references with the Harwell reference, do not disclose, teach, or even suggest Applicant's inventions.

In view of the above, it is respectfully requested that the Examiner withdraw the rejection of claims 9 and 21, and thus claims 9-20 and 21-33 for depending therefrom, under 35 U.S.C. 103(a), as applicable to claims now pending in the application.

Allowable Subject Matter

Applicants appreciate the allowance of claim 34 and thank the Examiner for the expeditious examination and allowance of said claim.

CONCLUSION

It is respectfully submitted that this application, as now amended, is in condition for allowance for the reasons stated above. Therefore, it is requested that the Examiner reconsider each and every rejection as applicable to the claims pending in the application and pass such claims to an expedient issue.

The foregoing is meant to be a complete response to the Office Action mailed December 11, 2008.

In the event that any outstanding issues remain that would delay the allowance of this application, the examiner is urged to contact the undersigned to telephonically discuss such outstanding issues.

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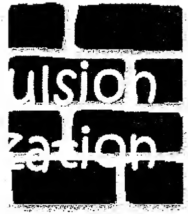
by Dennis Parrish

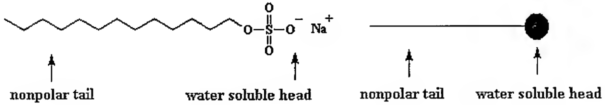


The definition for emulsion is: "A stable colloidal suspension as milk, consisting of an immiscible liquid dispersed and held in another liquid by a substance called an emulsifier".

In order to understand emulsion polymerization and emulsifiers, we've got to understand how soap works. Yes, soap! If you already know how soap works and have Grandma's recipe for lye soap, click here to get to the part on emulsion polymerization. If you're curious, then read on!

Soap's Dirty Job

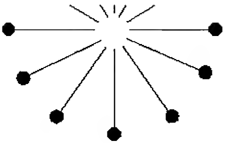
Soap molecules suffer from a multiple personality disorder, but their dual personalities are always apparent. A soap, or surfactant as it is referred to in emulsion polymerizations, has two ends of different solubility. One end, termed the tail, is a long hydrocarbon that is soluble in nonpolar, organic compounds. The other, the head, is often a sodium or potassium salt, which is water soluble. The water soluble salt can be the salt of a carboxylic acid or sulfonic acid. The technical term for the chemical display of "dual personalities" is *amphipathic.*



Sodium Lauryl Sulfate

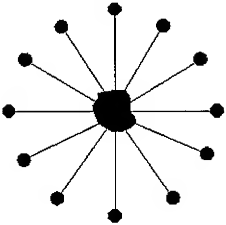
Lazy chemist's representation of Sodium Lauryl Sulfate

One soap molecule isn't much good to you. But when you get a whole bunch of 'em together, neat stuff starts to happen. At a certain concentration in water, soap molecules congregate and form micelles. Scientists have an apt (if not original) name for this called the critical micelle concentration, or CMC for short. Don't let the scientists fool you; they're really doin' the hokey pokey, tails inward.



Any dirt, grease, or grime that you happen to have on your hands is most likely organic and looks like this:

When you wash your hands with soapy water the hokey pokey party really gets goin'. The jubilant dirt particle jumps right in the middle where it's pretty happy. It doesn't want to get out so it stays dissolved in the organic tails of the micelle.



Now the dirt is dissolved in the micelle, and the micelle is dissolved in water, and...Voila! With copious amounts of water, you can wash everything down the drain.

Party Pooper.

Now a question for you: Why is it difficult to take a bath in the ocean?

Finally...Emulsion Polymerization

In an emulsion polymerization, the soap, or surfactant, is dissolved in water until the critical micelle concentration (CMC) is reached. The interior of the micelle provides the site necessary for polymerization. A monomer (like styrene or methyl methacrylate) and a water soluble free radical initiator are added and the whole batch is shaken or stirred (sorry, James Bond). Emulsion polymerizations are always performed free radically. Anionic and cationic chain ends would be rapidly quenched by the water. The product of an emulsion polymerization is called a latex; does the term "latex paint" ring a bell?

Location, Location, Location

Once everything is thrown in the pot, the monomer can be found in three different places. First, it can be in large monomer droplets floating around aimlessly in the water. Second, some of the monomer may be dissolved in the water, but this is unlikely. Remember, organic monomers like styrene and methyl methacrylate are hydrophobic. Lastly, the monomer may be found in micelles, which is exactly where we want it. Now look back at the definition at the beginning of this page. The immiscible liquid is the hydrophobic monomer, the mother liquor is water, and the emulsifier is soap.

Initiation and Polymerization

Initiation takes place when an initiator fragment migrates into a micelle and reacts with a monomer molecule. Water soluble initiators, such as peroxides and persulfates, are commonly used (This also prevents polymerization in the big monomer droplets). Once polymerization starts, the micelle is referred to as a particle. Polymer particles can grow to extremely high molecular weights, especially if the initiator concentration is low. That makes the radical concentration and the rate of termination low as well. Sometimes a chain transfer agent is added to the mix to keep the molecular weight from getting too high.

Propagation

Monomer migrates from the large monomer droplets to the micelles to sustain polymerization. On average, there is one radical per micelle. Because of this, there isn't much competition for monomer between the growing chains in the particles, so they grow to nearly identical molecular weights and the polydispersity is very close to one. Practically all the monomer is consumed in emulsion polymerizations, meaning the latex can be used without purification. This is important for paints and coatings. Just add some color to the latex, pour it into a can, and it's ready to use.

Here's the neat aspect of emulsion polymerization: each micelle can be considered as a mini bulk polymerization. Unlike traditional bulk polymerizations there is no unreacted monomer leftover, and no thermal "hot spots" form. In bulk polymerizations (no solvent, just monomer and initiator), thermal hot spots cause degradation and discoloration and chain transfer broadens the molecular weight distribution. An increase in temperature sometimes cause the rate of polymerization to increase explosively. The water here acts as a heat sink for all those mini reactors and keeps them from blowing up! Pyromaniacs don't do emulsion polymerizations.

Molecular Weight

Now this is cool too: The rate of polymerization is the same as the rate of disappearance of monomer. Monomer disappears faster when there are more particles. In order to have more particles there must be more micelles. If the soap sud concentration is increased, this ought to give us more micelles. Now suppose the concentration of initiator is left the same. This will give us more particles and less radicals. What this means is the number of radicals per micelle drops below one. In other words, the rate of termination will be low since there are less radicals. WHEW!

So the end result is this: *decreasing the initiator concentration increases molecular weight and rate of polymerization!* This is completely opposite from bulk and solution polymerization. To increase the rate of polymerization for those you have to heat the reaction or increase the initiator concentration, both of which increase the rate of termination and lower the molecular weight.

Practically Speaking

Sounds neat, but is it useful? Sure is. Poly(vinyl acetate),polychloroprene, polymethacrylates, poly(vinyl chloride), polyacrylamide, and copolymers of polystyrene, polybutadiene, and polyacrylonitrile are made commercially by emulsion polymerization.

Congratulations!

You've waded through the muck to get this far, unless, of course, you skipped down to the bottom to see if anything cool was here. The set-up now gets paid off with this handy-dandy, easy to decipher table that lists the good and the bad (and, believe me, it's all ugly!).

Polymerization Process	The Good	The Bad
Bulk	Only monomer is present--no extra stuff, High molecular weights	Thermal hotspots, High viscosity, Unreacted monomer present
Solution	Easy temperature control, Control of molecular weight	Must remove solvent, Chain transfer to solvent
Emulsion	All monomer reacts, Latex is usable "as is", Thermally controllable, Can make low Tg materials, Low viscosity	Presence of surfactant may cause water sensitivity

References and Further Reading

(i.e., more complicated and detailed reading)

Odian, G., "Principles of Polymerization" 3rd Ed., John Wiley and Sons, Inc., New York, 1991.

Rosen, S.L., "Fundamental Principles of Polymeric Materials" 2nd Ed., John Wiley and Sons, Inc., New York, 1993.

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